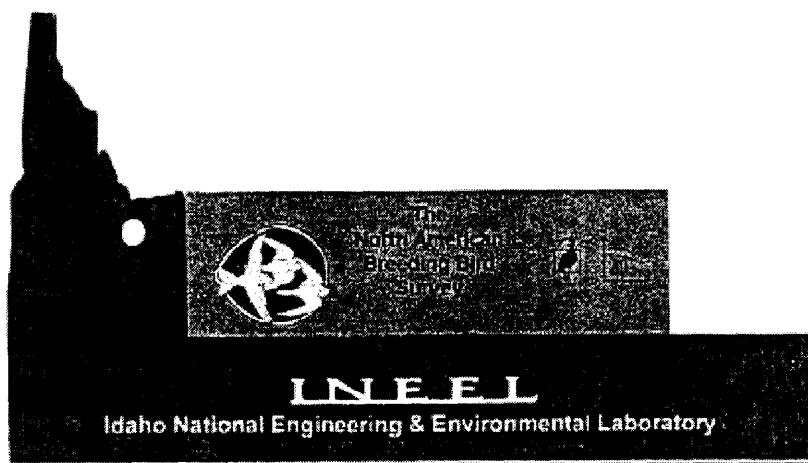


**Appendix H11**  
**Breeding Bird Surveys**

1999 BREEDING BIRD SURVEYS AT THE  
IDAHO NATIONAL ENGINEERING  
AND ENVIRONMENTAL LABORATORY



Prepared for:  
Environmental Science and Research Foundation  
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## Executive Summary

From 11 - 27 June 1999, 13 permanent routes located at the Idaho National Engineering and Environmental Laboratory (INEEL) were surveyed for birds. A 14th route established in 1997, IRR Circle, was surveyed on 27 June 1999. A total of 6,055 individuals representing 66 species of birds was recorded along the 13 permanent routes. This is the third highest total recorded and the third consecutive year that more than 6,000 birds were observed. The large number of birds observed could be related to relatively cool and wet weather in the spring of 1999 (Belthoff and Smith 1998, Belthoff et al. 1998). The surveys recorded two species of birds not observed in previous years: Black-throated Sparrow (*Amphispiza bilineata*) and Townsend's Solitaire (*Myadestes townsendi*).

This brings the total number of species to 112 and the total number of birds

Mallards (*Anas platyrhynchos*),  
Northern Shovelers (*Anas clypeata*),  
*semipalmatus*), Spotted Sandpipers



observed along the routes since 1985

counted to 59,173. Eight species,

Northern Pintails (*Anas acuta*),

Willetts (*Catoptrophorus*

(*Actitis macularia*), Northern Harriers

(*Circus cyaneus*), Swainson's Hawks (*Buteo swainsoni*), and Red-winged Blackbirds (*Agelaius phoeniceus*) were more abundant than in previous years (i.e., greater than 2.5 standard deviations above their 1985-1998 averages). Mallards, Northern Pintails, Willets, Spotted Sandpipers, Red-winged Blackbirds, and in some areas, Northern Harriers, all are associated with aquatic habitats, and their increase in abundance probably resulted from higher water levels within the study area in 1999. Swainson's Hawks are a species of special concern and increased observations of these raptors suggests that the INEEL continues to provide important shrubsteppe habitat. Other species of special concern recorded in 1999 included Loggerhead Shrikes (*Lanius ludovicianus*,  $N = 32$ ), Ferruginous Hawks (*Buteo regalis*,  $N = 13$ ), and Burrowing Owls (*Athene cunicularia*,  $N = 1$ ). As in recent years (1996-1998), none of the species observed in 1999 were 2.5 or more standard deviations below long-term (1985 - 1998) average abundance, although several species recorded in previous years were not observed in 1999.



Young Loggerhead Shrikes (*Lanius ludovicianus*) near Antler Road, Idaho National  
Engineering and Environmental Laboratory,  
June 1959

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## Introduction

The Breeding Bird Survey (BBS) is a roadside route survey of avifauna designed to monitor abundance and distribution of birds in both the United States and southern Canada. It began in the eastern U.S. in 1966 but is now nationwide in scope, with over 3000 routes surveyed annually (Bystrak 1981, Robbins et al. 1986). Data from these censuses are one of the main sources of information on avian population trends across the continent. Because methods are standardized, comparisons across years and regions of the country are possible, and a variety of local or regional assessments have been conducted (e.g., Geissler and Noon 1981, Holmes and Sherry 1988, Sauer and Droege 1990).

Recent reports have documented population changes in the avifauna of the eastern U.S. (e.g., Sauer and Droege 1990, Askins et al. 1990, Finch and Stangel 1992, Hagan and Johnston 1992), but patterns of population change in western states have remained understudied in comparison. Insufficient route coverage over much of the western U.S. has limited attempts to compare trends in BBS data for populations of many western species (Sauer and Droege 1992). Despite such limitations, Paige (1990) indicated that in every major habitat in the West there are key species that warrant either concern or immediate action. Of particular interest were shrubsteppe and grassland habitats, which apparently experienced widespread declines in avifauna (Paige 1990).

The Idaho National Engineering and Environmental Laboratory (INEEL), located in southeastern Idaho, contains large expanses of relatively undisturbed shrubsteppe and grassland habitat. This area was designated as a National Environmental Research Park in 1975 and serves as an outdoor laboratory to assess environmental impacts of energy development technologies. Since 1985, official BBS and modified "mini-routes" have been

surveyed at the INEEL. These surveys have yielded useful information about population dynamics and the breeding status of a number of bird species of concern, including sagebrush obligate species and other species exhibiting declines throughout their range (e.g., see Belthoff and Ellsworth 1996, Belthoff and Smith 1997, Belthoff and Smith 1998, Belthoff et al. 1998).

This report summarizes results of 1999 surveys at the INEEL and briefly compares findings to those from previous years.

### Study Area

The 2,315 km<sup>2</sup> INEEL is located approximately 48 km west of Idaho Falls on the upper Snake River Plain and occupies portions of Bingham, Bonneville, Butte, Clark, and Jefferson counties, Idaho. The area is a semiarid, cold desert with an average elevation of approximately 1500 m above sea level. Anderson et al. (1996) detailed the climate, geology, and vegetation of the INEEL. Briefly, vegetation in the study area is typical of shrubsteppe ecosystems and is dominated by woody, mid-height shrubs and perennial bunchgrasses. Common plant species include sagebrush (*Artemisia* spp.), green rabbitbrush (*Chrysothamnus viscidiflorus*), shadscale (*Atriplex confertifolia*), winterfat (*Krascheninnikovia lanata*), squirreltail (*Elymus elymoides*), thickspike wheatgrass (*Elymus lanceolatus*), needle and thread grass (*Hesperostipa comata*), and ricegrass (*Achnatherum hymenoides*). The topography is flat to gently rolling, but two isolated buttes protrude from the southern portion of the area. Two large, parallel mountain ranges (Lost River Mountains and Lemhi Mountains) rise above the Snake River Plain to the north and west. The study area experiences hot summers and cold winters (Short 1986). Annual precipitation averages approximately 20 cm, and most of this occurs during the spring. Surface water is limited to

residual flows of the Big Lost River and Birch Creek, each of which are diverted upstream of the site for agriculture and flood prevention. Several human-made wastewater treatment ponds occur near research facilities and attract birds that prefer aquatic habitats.

### Methods

From 11 - 27 June 1999, 13 permanent routes and one recently established route were surveyed for birds. These included five 40-km remote routes that traversed the major habitat types within relatively remote areas of the site. These were standard BBS routes, from which data are reported to the U.S. Geological Survey, Biological Resources Division annually. Standard BBS protocol (Robbins et al. 1986) was followed in completing each of these surveys. Briefly, routes were driven in a four-wheel drive vehicle, and the number of individuals of each bird species detected during 3-min observation sessions at each stop were recorded. Stops were located every 0.8 km (0.5 miles), and birds were counted if they occurred within 0.4 km of the observer. Eight shorter facility complex routes, located in and around major INEEL facility complexes, ranged from 5.8 - 19.2 km in length. Surveys along the shorter facility complex routes were similar to remote routes, except that stops were closer together (0.32 km) and birds were counted within a 0.16-km radius of each stop. A newer survey route (IRR Circle; containing six stops 0.32 km apart) was established in 1997 around the irrigation circle, located near the Central Facilities Area. This area is part of an experiment designed to monitor how wastewater management affects flora and fauna. We recorded temperature, wind speed, and cloud cover at the start and end of each survey. Surveys were performed only when weather conditions were satisfactory as prescribed by the BBS protocol. Routes took from approximately 50 min to 6 h to complete.

The five remote routes were surveyed on the following dates in 1999: Big Lost River - 11 June, Tractor Flats - 12 June, Kyle Canyon - 15 June, Circular Butte (Monument) - 16 June, Twin Buttes - 22 June. Facility complex routes were surveyed on the following dates in 1999: ICPP - 13 June, NRF - 14 June, EBRII (ANLW) - 18 June, RWMC - 20 June, TRA - 21 June, PBF-SPERT - 23 June, TAN - 25 June, CFA - 27 June. The newly established route, IRR Circle, was surveyed using facility route protocol on 27 June; however, because this route was surveyed after completion of the CFA route, the survey did not begin one-half hour before sunrise as other routes had. Results for IRR Circle are in Appendix A but are not summarized in this report because of differences in survey protocol and lack of data from previous years for comparison. Means and standard deviations are presented throughout this report.

## Results and Discussion

### Bird abundance and species richness



*Abundance* —A total of 6,055 individual birds was recorded along the 13 survey routes (Table 1). This is greater than the 1985-1998 average of 4,424.4 birds/year (no surveys were conducted in 1992 or 1993), and is (1) the third highest total ever, and (2) the third consecutive year that more than 6,000 birds were observed (Fig. 1). The total number of birds counted during surveys (1985 – 1999) is now 59,173 (Appendix B contains a summary of each species by year).

One explanation for high annual bird totals at the INEEL in recent years is cool and/or wet weather during the survey month (see Belthoff et al. 1998, Belthoff and Smith 1998).

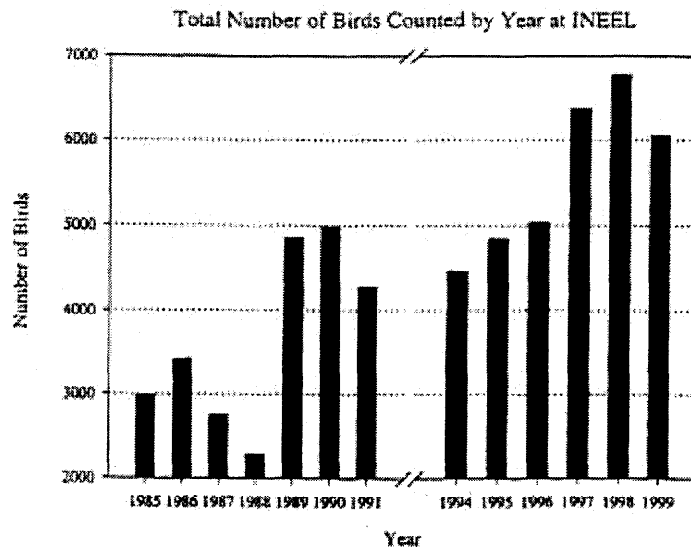


Figure 1. Total number of birds recorded by year (1985 – 1999) along 13 permanent routes at the Idaho National Engineering and Environmental Laboratory.

A correlation between cool and wet June weather and high bird counts was found for 1985 – 1991 surveys at the INEEL (Belthoff et al. 1998), and a similar relationship is apparent over all years (CFA weather data; Figs. 2 and 3). The relationship between June temperatures and total number of birds counted is the most striking (Spearman rank correlation:  $r_s = -0.762$ ,  $N = 13$ ,  $P = 0.002$ ). Indeed, the highest bird count occurred in the year with the lowest average June temperature (1998), and the four lowest bird counts were in the four warmest years (1985 – 1988; Fig. 2). Interestingly, 1999 was the third coolest June, and the third highest number of birds was recorded. There also appears to be a positive correlation ( $r_s = 0.448$ ,  $N = 13$ ,  $P = 0.124$ ) between precipitation in June and the number of birds counted (Fig. 3); the correlation would be stronger and statistically significant were it not for the exceptionally high precipitation in 1995 (4.64 in.). In 1994, for example, a near average number of birds was counted ( $N = 4,462$ ) despite receiving no precipitation in June. Likewise, 1996 and 1999

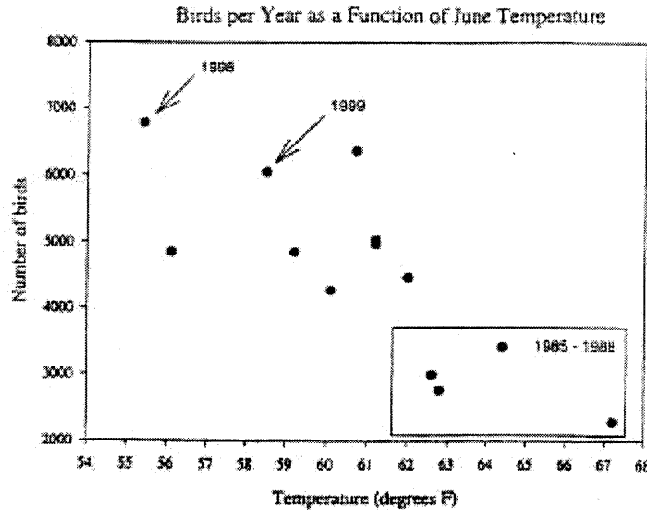


Figure 2. Relationship between mean June temperature and number of birds recorded along 13 permanent survey routes at the Idaho National Engineering and Environmental Laboratory (values mentioned in text are identified).

received less than average precipitation but recorded above average bird numbers ( $N = 5037$  and  $N = 6055$ , respectively). However, the four years with the lowest bird counts all received less than average precipitation, and it seems likely that an interaction between temperature and precipitation most strongly influenced bird counts.

Overall, there were  $465.8 \pm 195.3$  ( $N = 13$ ) birds per route. The average number of birds per route was greater for remote routes ( $684.6 \pm 108.0$ ,  $N = 5$ ) than for facility complex routes ( $329.0 \pm 55.8$ ,  $N = 8$ ), but remote routes generally had more stops (Table 2) and surveyed larger areas per stop. Thus, the density of birds was greater along facility complex routes than along remote routes (Table 2), which is consistent with longer-term data that show that the former support significantly more individuals per unit area (see Belthoff et al. 1998). Appendix A contains a list of species observed and their relative abundance along each of the 13 permanent survey routes and the IRR Circle.

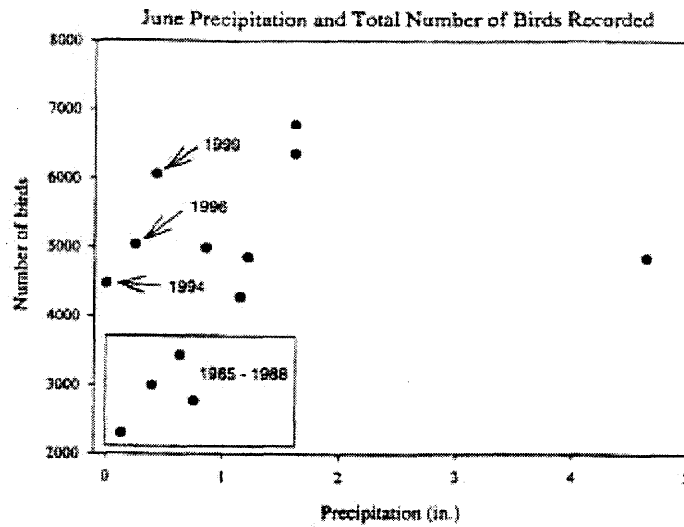


Figure 3. Relationship between total number of birds recorded along 13 permanent survey routes and June precipitation at the Idaho National Engineering and Environmental Laboratory (values mentioned in text are identified).

*Species Richness* —The total of 66 species detected during the 1999 surveys (Table 1) was equal to the second highest total recorded (Fig. 4). Also, a Black-throated Sparrow (*Amphispiza bilineata*) and a Townsend's Solitaires (*Myadestes townsendi*) were recorded for the first time during BBS surveys at the INEEL. This increases the total number of species detected along the routes (1985 – 1999) to 112. However, many of these 112 species are recorded only rarely (see Belthoff and Ellsworth 1996, Belthoff and Smith 1997, Belthoff and Smith 1998, Belthoff et al. 1998). In 1999, there were  $23.9 \pm 7.2$  species per route, which was equal to the highest average observed for 1985 - 1998 (range: 16.0 - 23.9). More species were recorded along remote routes ( $28.8 \pm 9.4$ ) than along facility complex routes ( $20.9 \pm 3.1$ ). The fewest number of species ( $N = 16$ ) were observed along the Circular Butte route, while the Kyle Canyon route had the greatest number of species ( $N = 39$ ).

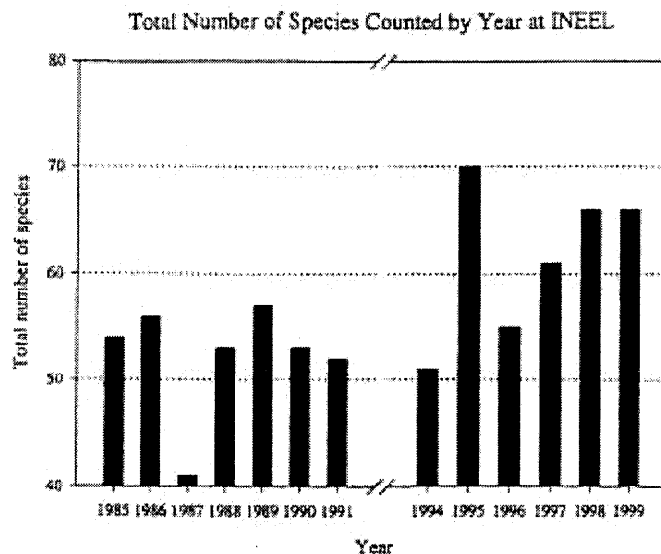


Figure 4. Total number of species recorded by year (1985 – 1999) along 13 permanent routes at the Idaho National Engineering and Environmental Laboratory.

Overall, the five most numerous species in order of abundance were Horned Larks, *Eremophila alpestris*; Brewer's Sparrows, *Spizella breweri*; Western Meadowlarks, *Sturnella neglecta*; Sage Thrashers, *Oreoscoptes montanus*; and Sage Sparrows, *Amphispiza belli*. These five species together comprised 69.7% of the birds detected. Similarly, these species accounted for 72.2% of all birds observed from 1985-1998. Although there have been minor shifts in the order of abundance over these years, it is clear that these five species, three of which are sagebrush obligates (Brewer's Sparrows, Sage Sparrows, and Sage Thrashers; see Belthoff et al. 1998), are dominant components of the ecosystems at the INEEL.

#### Comparisons with long-term averages

In 1999, several species had an abundance greater than 2.5 standard deviations above 1985 - 1998 averages (Table 3). Most of the species that showed a marked increase in abundance were associated with aquatic habitats (i.e., Mallards, *Anas platyrhynchos*; Northern Pintails, *Anas acuta*; Spotted Sandpipers, *Actitis macularia*; Willets, *Catoptrophorus*

*semipalmatus*; Red-winged Blackbirds, *Agelaius phoeniceus*; and in some areas, Northern Harriers, *Circus cyaneus*) and their increase may be related to high water levels and cool weather at the site in 1999. In particular, water levels in the Lost River were high throughout the survey period and may have accounted for high numbers of species such as Spotted Sandpipers, which have increased for the second year in a row (Belthoff and Smith 1998). However, in 1999 the Twin Buttes route was 're-routed' between stops 44 – 50, and the last three of these stops were near a small reservoir on the Lost River. Seventy percent (112 of 161) of all ducks were observed at these stops, and this change possibly confounds comparisons among years in abundance of waterfowl and possibly other waterbirds. It is unlikely that the route change would influence the observations of shrub or grassland species because only seven stops were different than previous years and much of the terrain along the new route (aside from the reservoir) is similar to the old route.

As in the past three years, no species were more than 2.5 standard deviations below their long-term average abundance. However, several species observed in six or more previous years were absent in 1999, including American Coot (*Fulica americana*), Sage Grouse (*Centrocercus urophasianus*), Gadwall (*Anas strepera*), Ruddy Duck (*Oxyura jamaicensis*), Prairie Falcon (*Falco mexicanus*), Eastern Kingbird (*Tyrannus tyrannus*), California Gull (*Larus californicus*), and Northern Rough-winged Swallow (*Stelgidopteryx serripennis*). Although these species were not observed during surveys, all were observed at other times in the spring and summer of 1999 at the Idaho National Engineering and Environmental Laboratory.

#### Species of special concern

In 1999, seven Swainson's Hawks were observed, which was greater than any other year (2.9 standard deviations above the 1985 – 1998 mean). This is encouraging because of recent concerns about Swainson's Hawk mortality on their wintering grounds in Argentina (Woodbridge et al. 1995) and elsewhere. Other species of special concern observed during the 1999 census included Long-billed Curlews (*Numenius americanus*, N = 8), which were not recorded in 1998, Ferruginous Hawks (*Buteo regalis*, N = 13), Burrowing Owls (*Athene cunicularia*, N = 1), and Loggerhead Shrikes (*Lanius ludovicianus*, N = 32; Table 1).

#### **Summary**

Results from the 1999 Breeding Bird Surveys at the INEEL were more or less consistent with past years. As in other years with cool June temperatures, a high number of birds were recorded in 1999. The five most abundant species in 1999 were the same as in most previous years reflecting the dominance of these species in structuring the avian community in the INEEL ecosystems. Also, the average number of birds per route was greater for remote routes than for facility complex routes, but the density of birds was greater along facility complex routes than along the remote routes. Species richness (N = 66) was high, and two previously unrecorded species were observed (Black-throated Sparrow, Townsend's Solitaire). Finally, one species of special concern, Swainson's Hawks, was observed in significantly higher numbers than usual, and four others were recorded (Long-billed Curlew, Loggerhead Shrike, Ferruginous Hawk, and Burrowing Owl).

### Acknowledgments

We thank Drs. T. Reynolds and D. Markham, the Environmental Science and Research Foundation, and the U.S. Department of Energy-Idaho for facilitating our participation in the breeding bird surveys at INEEL. For logistical support or assistance with field work, we thank V. Arpin, S. Majors, T. Reynolds, C. Rideout, R. Warren, several field assistants provided by the Environmental Science and Research Foundation, and Boise State University. We also thank C. Rideout for permission to use the photograph reproduced in the frontispiece, and B. Smith for comments on earlier versions of this report.

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Table 1. Birds observed along 13 Breeding Bird Survey routes at the Idaho National Engineering and Environmental Laboratory during the 1999 census. Number (and percentage of total) of each species, type of route along which birds were encountered, and number of stops (and percentage of total) at which each species occurred are indicated.

Common Name	Scientific Name	N	%	Routes <sup>a</sup>	Stops <sup>b</sup>	%
Horned Lark	<i>Eremophila alpestris</i>	1094	18.1	5,8	335	67.7
Brewer's Sparrow	<i>Spizella breweri</i>	1065	17.6	5,8	406	82.0
Western Meadowlark	<i>Sturnella neglecta</i>	1004	16.6	5,8	408	82.4
Sage Thrasher	<i>Oreoscoptes montanus</i>	535	8.8	5,8	320	64.6
Sage Sparrow	<i>Amphispiza belli</i>	526	8.7	5,8	294	59.4
Mourning Dove	<i>Zenaida macroura</i>	416	6.9	5,8	194	39.2
Brown-headed Cowbird	<i>Molothrus ater</i>	260	4.3	5,8	166	33.5
Vesper Sparrow	<i>Poocetes gramineus</i>	150	2.5	5,3	93	18.8
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>	137	2.3	4,7	42	8.5
European Starling	<i>Sturnus vulgaris</i>	95	1.6	1,8	35	7.1
Mallard	<i>Anas platyrhynchos</i>	89	1.5	2,3	11	2.2
Common Nighthawk	<i>Chordeiles minor</i>	66	1.1	5,4	52	10.5
Barn Swallow	<i>Hirundo rustica</i>	47	0.8	0,7	21	4.2
House Finch	<i>Carpodacus mexicanus</i>	47	0.8	2,6	22	4.4
Killdeer	<i>Charadrius vociferus</i>	40	0.7	1,7	27	5.5
Northern Pintail	<i>Anas acuta</i>	34	0.6	2,1	3	0.6
Rock Wren	<i>Salpinctes obsoletus</i>	33	0.5	5,6	27	5.4
Loggerhead Shrike	<i>Lanius ludovicianus</i>	32	0.5	5,5	25	5.0
Common Raven	<i>Corvus corax</i>	30	0.5	5,4	22	4.4

Table 1. *Continued.*

Common Name	Scientific Name	N	%	Routes <sup>a</sup>	Stops <sup>b</sup>	%
Black-billed Magpie	<i>Pica pica</i>	30	0.5	4,4	13	2.6
Northern Shoveler	<i>Anas clypeata</i>	26	0.4	1,3	6	1.2
American Kestrel	<i>Falco sparverius</i>	25	0.4	3,6	22	4.4
Gray Flycatcher	<i>Empidonax wrightii</i>	24	0.4	3,0	14	2.8
Northern Harrier	<i>Circus cyaneus</i>	18	0.3	4,3	18	3.6
Wilson's Phalarope	<i>Phalaropus tricolor</i>	16	0.3	1,2	3	0.6
Bank Swallow	<i>Riparia riparia</i>	16	0.3	0,4	5	1.0
American Robin	<i>Turdus migratorius</i>	16	0.3	2,3	11	2.2
Ferruginous Hawk	<i>Buteo regalis</i>	13	0.2	4,1	12	2.4
Short-eared Owl	<i>Asio flammeus</i>	13	0.2	3,2	12	2.4
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	13	0.2	2,2	5	1.0
Chipping Sparrow	<i>Spizella passerina</i>	13	0.2	1,0	7	1.4
American Avocet	<i>Recurvirostra americana</i>	10	0.2	1,1	2	0.4
Lark Bunting	<i>Calamospiza melanocorys</i>	9	0.1	2,0	4	0.8
Long-billed Curlew	<i>Numenius americanus</i>	8	0.1	1,1	6	1.2
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	7	0.1	3,3	6	1.2
Say's Phoebe	<i>Sayornis saya</i>	7	0.1	1,3	5	1.0
Rock Dove	<i>Columba livia</i>	7	0.1	1,1	3	0.6
Swainson's Hawk	<i>Buteo swainsoni</i>	7	0.1	3,0	6	1.2
Willet	<i>Catoptrophorus semipalmatus</i>	6	0.1	3,0	6	1.2
Spotted Sandpiper	<i>Actitis macularia</i>	6	0.1	0,3	4	0.8

Table 1. *Continued.*

Common Name	Scientific Name	N	%	Routes <sup>a</sup>	Stops <sup>b</sup>	%
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>	6	0.1	2.0	5	1.0
Northern Flicker	<i>Colaptes auratus</i>	6	0.1	3.0	5	1.0
Lark Sparrow	<i>Chondestes grammacus</i>	5	0.1	2.0	4	0.8
Cinnamon Teal	<i>Anas cyanoptera</i>	4	0.1	2.0	2	0.4
Red-tailed Hawk	<i>Buteo jamaicensis</i>	4	0.1	1.0	3	0.6
Lazuli Bunting	<i>Passerina amoena</i>	4	0.1	1.0	1	0.2
House Sparrow	<i>Passer domesticus</i>	4	0.1	1.1	3	0.6
Western Kingbird	<i>Tyrannus verticalis</i>	3	<0.1	1.0	3	0.6
American Wigeon	<i>Anas americana</i>	2	<0.1	0.1	1	0.2
Green-winged Teal	<i>Anas crecca</i>	2	<0.1	1.0	1	0.2
Blue-winged Teal	<i>Anas discors</i>	2	<0.1	0.1	1	0.2
Redhead	<i>Aithya americana</i>	2	<0.1	1.0	1	0.2
Golden Eagle	<i>Aquila chrysaetos</i>	2	<0.1	2.0	2	0.4
Chukar	<i>Alectoris chukar</i>	2	<0.1	1.0	1	0.2
Gray Partridge	<i>Perdix perdix</i>	2	<0.1	2.0	2	0.4
Bullock's Oriole	<i>Icterus bullockii</i>	2	<0.1	1.0	1	0.2
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>	2	<0.1	1.1	2	0.4
Mountain Bluebird	<i>Sialia currucoides</i>	2	<0.1	1.0	1	0.2
Western Tanager	<i>Piranga ludoviciana</i>	2	<0.1	2.0	2	0.4
Eared Grebe	<i>Podiceps nigricollis</i>	1	<0.1	0.1	1	0.2
Great-horned Owl	<i>Bubo virginianus</i>	1	<0.1	1.0	1	0.2

Table 1. *Continued.*

Common Name	Scientific Name	N	% Routes <sup>a</sup>	Stops <sup>b</sup>	%	
Burrowing Owl	<i>Athene cunicularia</i>	1	<0.1	0.1	1	0.2
American Crow	<i>Corvus brachyrhynchos</i>	1	<0.1	1.0	1	0.2
Townsend's Solitaire	<i>Myadestes townsendi</i>	1	<0.1	1.0	1	0.2
American Goldfinch	<i>Carduelis tristis</i>	1	<0.1	0.1	1	0.2
Black-throated Sparrow	<i>Amphispiza bilineata</i>	1	<0.1	1.0	1	0.2
TOTAL	6,055 individuals					
	66 species					

<sup>a</sup>Number of remote routes along which species occurred, number of facility complex routes along which species occurred.

<sup>b</sup>Number of stops at which species was detected.

Table 2. Number of species, number of individual birds, and average number of individuals per stop and per km<sup>2</sup> along Remote Routes (N = 5) and Facility Complex Routes (N = 8) at the INEEL in 1999.

Route	Stops	Species	N	Birds/Stop	Birds/km <sup>2</sup>
<i>Remote Routes</i>					
Circular Butte (Monument)	50	16	585	11.7	23.3
Kyle Canyon	50	39	712	14.2	28.3
Lost River	50	25	558	11.2	22.2
Tractor Flats	50	27	774	15.5	30.8
Twin Buttes	50	37	794	21.5	31.6
Subtotal	250	58	3,423	13.7	27.2
<i>Facility Complex Routes</i>					
CFA	42	20	450	10.7	133.2
EBRII	18	25	314	17.4	216.9
ICPP	25	20	298	11.9	148.2
NRF	20	26	288	14.4	179.0
PBF-SPERT	28	18	324	11.6	143.8
RWMC	20	20	270	13.5	167.8
TAN	60	21	357	5.6	74.0
TRA	32	17	331	10.3	128.6
Subtotal	245	41	2,632	10.7	133.6
TOTAL	495	66	6,055	12.2	41.6

Table 3. Species recorded during the 1999 census whose abundance was more than 2.5 standard deviations from 1985 - 1998 averages. Species are arranged by 1999 relative abundance.

Species	1985-1998 Average*	1999 (N)	Difference in Standard Deviations
Mallard	13.0 ± 8.5 (9)	89	+ 8.9
Northern Pintail	3.8 ± 3.4 (4)	34	+ 8.9
Northern Shoveler	6.3 ± 5.7 (12)	26	+ 3.4
Northern Harrier	8.6 ± 3.8 (12)	18	+ 2.5
Red-winged Blackbird	4.0 ± 2.6 (7)	13	+ 3.5
Swainson's Hawk	3.5 ± 1.2 (11)	7	+ 2.9
Spotted Sandpiper	1.7 ± 0.8 (6)	6	+ 5.3
Willet	1.7 ± 0.8 (6)	6	+ 5.3

\*Average abundance in previous years in which species was detected. Number of years in which species was detected is in parentheses. Note: no surveys were conducted in 1992 - 1993.